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been amended in accordance with the Examiner's suggestion. The Examiner has rejected claims 12, 19, 26-27 under 35 USC §102(b) as being anticipated by **Ruppel et al.** (US 5,821,390). The Examiner argues that **Ruppel et al.** discloses a multitube reactor with a catalyst tube bundle arranged within an outer wall. In particular the Examiner argues that **Ruppel et al.** teaches that the ratio of tube spacing to the external diameter of the tube is 1.1-2.1. Furthermore, in example 7 of **Ruppel et al.**, the Examiner calculates a specific value of 1.3 when the external diameter of the tube is 30mm and the spacing between the tubes is 38mm.<sup>2</sup>

The present application, however, is not anticipated by **Ruppel et al.** because it does not disclose the elements of the present invention with sufficient specificity. As stated in MPEP §2131.03, when a reference discloses a range which touches, overlaps or is within the claimed range, but no specific examples fall within the claimed range, a case by case determination must be made as to anticipation. The case by case determination is made based on whether the claimed subject matter is disclosed in the reference with "sufficient specificity". Sufficient specificity cannot be found if there is unexpected results within the claimed narrow range.

In the case at hand, **Ruppel et al.** does not disclose any specific examples within the claimed range. As stated earlier, the Examiner calculated a specific value of 1.3 in example 7 of the **Ruppel et al.** reference. However, rounding to the third decimal place, an external diameter ( $d_a$ ) of 30mm and a tube spacing ( $t$ ) of 38mm is calculated to give a  $t/d_a$  ratio of 1.267. A  $t/d_a$  ratio of 1.267 is well below the claimed range of 1.3-1.6. Therefore, there is no specific example in **Ruppel et al.** which is within the claimed range.

Furthermore, **Ruppel et al.** does not disclose the currently claimed subject matter with sufficient specificity. The **Ruppel et al.** reference merely states that the internal diameters are generally 20 to 30mm and that the tube spacing can be from 35mm to 45mm. The reference gives no indication to one skilled in the art how to arrange the two ranges, or that any particular range would be significant. Therefore there is no specificity in the disclosure of **Ruppel et al.**

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<sup>2</sup> **Ruppel et al.**, column 7, lines 30-37.

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Moreover, the present invention provides examples of unexpected results compared to the closest available art, as cited by the Examiner. The comparative example on page 12 of the application employs a tube bundle wherein the external diameter was 30mm, and the tube spacing  $t$  was 38mm, similar to example 7 of **Ruppel et al.**, which gives a calculated  $t/d_a$  ratio of 1.267. The resulting yield from the comparative example was 77.8 mol% of phthalic anhydride. Alternatively, Example 1 on pages 11-12 of the application employs an external diameter of 29mm, and a tube spacing of 40mm. The resulting calculated  $t/d_a$  ratio was 1.3793, and produced a 78.9mol% yield of phthalic anhydride. The difference in yield constitutes a significant improvement for an industrial scale reactor. The striking difference in yield clearly reveals the tremendous technical effect of an even very moderate variation of the  $t/d_a$  ratio.

Therefore, with the unexpected results demonstrated in the Examples of the present application, the Applicant respectfully submits that it is reasonable to conclude that the current claims are not disclosed by **Ruppel et al.** with sufficient specificity so as to constitute anticipation.

The Examiner also rejected claims 12, 19, 26 and 27 under 35 USC §103(a) as being unpatentable over **Ruppel et al.** The Examiner argues that the ratio disclosed by **Ruppel et al.** of 1.1-2.1 entirely encompasses the Applicant's ratio of 1.3-1.6 and that a reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness.

However, a prima facie case of obviousness is not established if (1) unexpected results can be shown, and (2) that the cited reference teaches away from the current invention.<sup>3</sup> The Examiner must view the application as a whole, including the examples in the specification.<sup>4</sup> As previously discussed, the present application shows unexpected results are obtained from the critical range as claimed. Additionally, however, **Ruppel et al.** teaches away from the current invention. **Ruppel et al.** is, in fact, not concerned at all with  $t/d_a$  ratios. Even if **Ruppel et al.** discloses a range from 1.1-2.1, one skilled in the art, upon reviewing **Ruppel et al.**, would try to arrange the tubes as closely as possible while still allowing sufficient heat removal in order to maximize the number of tubes for

<sup>3</sup> In re Peterson, 315 F.3d 1325, 1330-31, 65 USPQ.2d 1379 (2003); In re Geisler, 116 F.3d 1465, 1469, 1471, 43 USPQ.2d 1362 (1997) MPEP §2144.05.

<sup>4</sup> *Antonie*, 559 F.2d 618, 195 USPQ 6, 8 (CCPA 1977).

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a given diameter of the whole reactor, as is shown by the examples of **Ruppel et al.** As shown by the examples, the exit temperature of the heat removal is accomplished in both cases, and therefore one skilled in the art would not expect any benefit from selecting a higher  $t/d_a$  ratio.

It was surprisingly found, however, that selecting a lower limit of 1.3, according to the present invention, allows for a higher heat transfer medium without having to increase pump power. A higher heat transfer medium flow allows for to increase the load of gaseous reactants and to fully benefit from employing modern highly efficient catalyst materials. Further, a higher heat transfer medium flow leads to a more uniform temperature distribution across the reactor cross section and to a reduction in the hot spots. This allows for an increase of the inflow temperature of the heat transfer medium without exceeding the maximum permissible exit temperature which leads to improved selectivity of the reaction and consequently an increase of yield.

Furthermore, a particular parameter must first be recognized as a result-effective variable before optimizing ranges through routine experimentation can be accomplished.<sup>5</sup> As stated previously, **Ruppel et al.** does not recognize the  $t/d_a$  ratio as a result effective variable. At most, **Ruppel et al.** merely generally lists what contact tubes internal diameter and spacing may be without, however, giving guidance as to which combination of  $t$  and  $d_a$  to select.

Therefore, the Applicant respectfully requests that the §102 and §103 rejections based on the **Ruppel et al.** reference be withdrawn.

The Examiner also rejected claims 13-16 under 35 USC §103(a) as being unpatentable over **Ruppel et al.** in view of **Westerman et al.** (US 4,894,205), and rejected claims 12, 17-19, 26-27 under 35 USC §103(a) as being unpatentable over **Groten et al.** (US 5,730,843) in view of **Ruppel et al.** Neither **Westerman et al.** nor **Groten et al.** narrow the gap between **Ruppel et al.** and the current application and therefore their combination does not render the current invention obvious. **Groten et al.** does not teach any ratios as claimed in the current application. Furthermore, **Westerman et al.** merely discloses that tube diameters are smaller in reactors with more tubes. There

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<sup>5</sup> MPEP §2144.05.II.B

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is no guidance given as to what combinations of  $t$  and  $d_a$  should be employed for increased effectiveness of a reactor.

In light of the foregoing remarks, the applicant respectfully requests that the §103 rejections be withdrawn.

The Examiner has required election of, and restriction of the application to, one of the following groups of claims:

Group I, claims 12-19, 26, and 27

Group II, claims 20-25

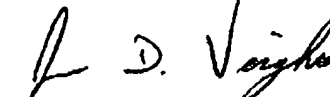
The Applicant herewith confirms the preliminary election of the group designated I made in the telephone conversation made on February 19, 2004. The Examiner argues that Groups I and II do not share a corresponding special technical feature because claim 12 is either obvious over or anticipated by **Ruppel et al.** Traversal of the Examiner's restriction requirement is hereby solicited. As previously discussed, **Ruppel et al.** does not anticipate nor render obvious the current invention. Unexpected results are shown in the Examples, and furthermore, **Ruppel et al.** teaches away from the current invention. Therefore Groups I and II share a corresponding special technical feature and therefore there is unity of invention.

REQUEST FOR EXTENSION OF TIME:

It is respectfully requested that a two month extension of time be granted in this case. The respective \$450.00 fee is paid by credit card (Form PTO-2038 enclosed).

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees, to Deposit Account No. 14.1437. Please credit any excess fees to such deposit account.

Respectfully submitted,  
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